UDC 633.15; 631.523
Original scientific paper

EFFECTS OF THE SOWING DENSITY ON THE YIELD AND THE NUMBER OF GERMINATED SEEDS IN SEED MAIZE

Predrag JOVIN[1], Milorad ROŠULJ[1], Miodrag TOLIMIR[1], and Jasmina MILENKOVIĆ[2]

[1]Maize Research Institute, Zemun Polje, Belgrade-Zemun,
[2]Agricultural Research Institute „Serbia“, Agricultural and Technological Research Centre, Zaječar, Serbia and Montenegro

Jovin P., M. Rošulj, M. Tolimir, and J. Milenković (2005): *Effects of the sowing density on the yield and the number of germinated seeds in seed maize*. – Genetika, Vol. 37, No. 1, 87-92.

The trials were carried out in the regular production of the seed maize ZP 680 at the agricultural estate “Nova Budućnost” Žarkovac during 2001 and 2002. Sowing densities (71,400, 85,500, 99,900 plants ha^{-1}) affected varying of yields (4.01, 4.38. 4.40 t ha^{-1}). The 1000-seed weight decreased over increased densities (305.6, 2912, 282.5 g). Germination was even over densities (95.0, 94.9, 94.7 %). A greater number of germinated seeds per area unit (13,122,000, 15,022,000, 15,569,000) was obtained in greater densities. The percentile share of fractions in the weight was uniform over all sowing densities.

Key words: sowing density, seed maize, 1000-seed weight, number of seeds per hectare, seed fraction

INTRODUCTION

Maize seed yields are affected by the sowing density among other factors. The plant spacing should be adjusted to the soil quality, i.e. to nutrient amounts,

Corresponding author: Milorad Rošulj, Maize Research Institute “Zemun Polje”, Slobodana Bajića 1, 11185 Zemun, Serbia and Montenegro
Tel: +381-11-3756704; fax: +381-11-3756707; e-mail: mrosulj@mrizp.co.yu

precipitation sum, genotype, that is a FAO maturity group of a certain hybrid, and to other factors. This is a reason for determining a sowing density for each ZP hybrid, which will result in high yields and a maximum number of germinated seeds.

The modern seed production requires profitability and quality. Profitability is related to the yield and mechanisation of all processes: harvest, ear receipt into the processing plants, drying, shelling and processing. Mechanisation, especially if applied in a wrong way, can affect seed quality. Due to the uniform quality, seed maize is processed and packed by fractions in which round fractions are separated from flat ones and within them the small seed fraction is separated from the large seed fraction.

Uniform seeds provides a desired number of screened seeds, even and good emergence and thereby a satisfactory plant spacing, which is one of prerequisites for high yields (MIRIĆ *et al*., 1998.).

The aim of the present study was to determine the optimum densities for obtaining high yields and the maximum number of germinated seeds per area unit.

MATERIALS AND METHODS

The experiments were conducted in the regular production of the seed maize ZP 680 under environmental growing conditions on calcareous chernozem at the agricultural estate "Nova Budućnost" Žarkovac during 2001 and 2002. The effect of sowing density of female component (G_1 - 71,400, G_2 - 85,500, G_3 - 99,900 plant ha^{-1}) on seed yield and the number of germinated seeds per area unit, 1000-seed weight and fractional composition was studied. The three-replicate trial was performed according to the split plot method. The cropping practices were applied as in the regular seed maize production. Wheat was a preceding crop in both years. After wheat harvest, the soil was twice ploughed to the depth of 10-12 cm and 25-28 cm in autumn. A total of 400 kg $N_{15}P_{15}K_{15}$ ha^{-1} and 150 kg Urea ha^{-1} were applied in the pre-sowing cultivation.

The ratio of female component rows to male component rows was 4:2. The sample analysis was performed at the Seed Testing Laboratory of the Maize Research Institute, Zemun Polje. After the removal of impurities, drying and shelling, each sample was calibrated by the laboratory graders into four fractions (SF - small flat, SR - small round, LF - large flat and LR - large round seed fraction). The 1000-seed weight and germination were tested for each sample according the rules of International Seed Testing Association (ISTA), 1996.

RESULTS AND DISCUSSION

The higher sowing density was the higher yields were, both over years (2001 - 3.74, 4.09, 4.04 t ha^{-1}, 2002 - 4.29, 4.67, 4.77 t ha^{-1}) and on the average for years (4.01, 4.38, 4.40 t ha^{-1}) (Table 1). Yields obtained in the mean and highest sowing densities were similar. Gained results are in accordance with results obtained by JOVIN *et al*. (1999), MARINKOVIĆ and STARČEVIĆ (1989), PAVLOV (1989), MARINKOVIĆ *et al*. (1992).

Table 1. Effects of Sowing Density on Yield (tha^{-1})

Sowing density	Yield (t ha^{-1})		
	2001	2002	$\overline{X}$
71,400	3.74	4.29	4.01
85,500	4.09	4.67	4.38
99,900	4.04	4.77	4.40
$\overline{X}$	3.96	4.58	4.26

LSD 0.05=0.22; 0.01=0.28

Results obtained in the analysis of calibrated seeds (Table 2.) show that the highest 1000-seed weight (305.6 g) was achieved in the smallest sowing density and that it decreased over higher sowing densities.

Table 2. Effects of Sowing Density and Seed Fractions on 1000-Seed Weight and Germination (%)

Sowing density	Seed fraction	1000-seed weight (g)			Germination (%)		
		2001	2002	$\overline{X}$	2001	2002	$\overline{X}$
71,400	SF	240.0	255.0	247.0	95.0	94.0	94.5
	SR	255.0	290.0	272.5	93.0	93.0	93.0
	LF	315.0	335.0	325.0	97.0	96.0	96.5
	LR	370.0	385.0	377.5	97.0	95.0	96.0
	$\overline{X}$	295.0	316.2	305.6	95.5	94.5	95.0
85,500	SF	230.0	240.0	235.0	94.0	95.0	94.5
	SR	235.0	275.0	255.0	92.0	93.0	92.5
	LF	310.0	320.0	315.0	96.0	96.0	96.0
	LR	355.0	365.0	360.0	98.0	95.0	96.5
	$\overline{X}$	282.5	300.0	291.2	95.0	94.7	94.9
99,900	SF	220.0	235.0	227.5	93.0	94.0	93.5
	SR	230.0	260.0	245.0	95.0	92.0	93.5
	LF	300.0	310.0	305.0	97.0	95.0	96.5
	LR	350.0	355.0	352.5	96.0	95.0	95.5
	$\overline{X}$	275.0	290.0	282.5	95.2	94.0	94.7
$\overline{X}$	SF	230.0	243.3	236.7	94.0	94.3	94.2
	SR	240.0	275.0	257.5	93.3	92.7	93.0
	LF	308.3	321.7	315.0	96.7	95.7	96.3
	LR	358.3	368.3	363.3	97.0	95.0	96.0
	$\overline{X}$	284.2	302.1	293.1	95.2	94.4	94.8

Similar to the yield, the higher densities were the greater number of germinated seeds per area unit was: 2001 (12,678,000, 14,478,000, 14,691,000) and 2002 (13,567,000, 15,567,000, 16,448,000) and on the average for years (13,122,000, 15,022,000, 15,569,000) (Table 3.).

Table 3. Effects of Sowing Density on the Number of Germinated Seeds per Hectare

Sowing density	Number of germinated seeds ha^{-1}		
	2001	2002	$\overline{X}$
71,400	12,678,000	13,567,000	13,122,000
85,500	14,478,000	15,567,000	15,022,000
99,900	14,691,000	16,448,000	15,560,000
$\overline{X}$	13,949,000	15,194,000	14,571,000

In relation to the percentile share of fractions (Table 4.), the small flat fraction was mostly distributed (20.3%), and the share of the large round fraction was the least (12.9%) in the lowest sowing density. The share of the small round fraction was equal (12.1%) in the mean and the highest sowing densities and an insignificantly higher (13.5%) in the lowest sowing density. The large flat fraction was evenly present in all three sowing densities.

Table 4. Effects of Sowing Density on Percentile Share of Seed Fractions in Yield

Sowing density	Seed fraction	2001	2002	$\overline{X}$
71,400	SF	19.1	21.6	20.3
	SR	12.6	14.4	13.5
	LF	52.3	54.1	53.2
	LR	16.0	9.9	12.9
85,500	SF	16.8	18.5	17.6
	SR	10.6	13.7	12.1
	LF	55.0	51.8	53.4
	LR	17.6	16.0	16.8
99,900	SF	17.5	19.7	18.6
	SR	11.4	12.9	12.1
	LF	52.7	53.8	53.2
	LR	18.4	13.6	16.0
$\overline{X}$	SF	17.8	19.9	18.8
	SR	11.5	13.7	12.6
	LF	53.3	53.2	53.3
	LR	17.3	13.2	15.2

CONCLUSION

Based on the preformed experiments the following conclusions can be drawn:

- Yields obtained in sowing densities of 85,500 and 99,900 plants ha^{-1} were increased in relation to the yield obtained in the sowing density of 71,400 plants ha^{-1} (by 9.23% and 9.72%, respectively).
- The highest 1000-seed weight was obtained in the lowest sowing density.
- The sowing density did not affect seed germination.

- The number of germinated seeds per area unit increased over higher densities by 14.48% and 18.65%.
- Sowing densities did not affect the seed fractional composition.

Received November 12th, 2004.
Accepted February 7th, 2005

REFERENCES

ISTA (1996): International Rules for Seed Testing. Seed Science and Technology, *24*, 335.

JOVIN P., M. VESKOVIĆ, and Ž. JOVANOVIĆ (1999): Effects of increased planting density on yield and number of germinated seeds in seed maize. J. Sci. Agric. Research, *60* (211), 39-45.

MARINKOVIĆ B. and Lj. STARČEVIĆ (1989): Prinos semenskog kukuruza od oblika i veličine vegetacionog prostora. Savrem. poljopr., *3-4*, 113-120.

MARINKOVIĆ B., J. CRNOBARAC, and Lj. STARČEVIĆ (1992): Zavisnost prinosa hibrida od gustine i udaljenosti biljaka "majke" od oprašivača. Savrem. poljopr., *5*, 33-38.

PAVLOV M. (1989): Proučavanje rodnosti zrna i drugih važnih agronomskih osobina inbridovanih linija, sestrinskih ukrštanja i hibrida kukuruza F_1 generacije. MSc Thesis, Faculty of Agriculture, University of Belgrade, Belgrade.

UTICAJ GUSTINE SETVE NA PRINOS I BROJ KLIJAVIIH ZRNA U SEMENSKOM KUKURUZU

Predrag JOVIN[1], Milorad ROŠULJ[1], Miodrag TOLIMIR[1] i Jasmina MILENKOVIĆ[2]

[1]Institut za kukurut "Zemun Polje", 11185 Zemun,
[2]Institut za istraživanja u poljoprivredi „Srbija", Centar za poljoprivredna i tehnološka istraživanja, Zaječar, Srbija i Crna Gora

Izvod

Ogledi su izvedeni u PD "Nova Budućnost" Žarkovac 2001 i 2002. godine u prirodnim uslovima gajenja semenskog kukuruza ZP 680. Gustine setve (714.00, 85.500, 99.9.00 bilj/ha) su uticale na variranje prinosa (4.01, 4.38. 4.40 t/ha). Masa 1000 semena opadala je sa povećanjem gustine (305.6, 2912, 282.5 g). Klijavost je bila ujednačena po gustinama (95.0, 94.9, 94.7 %). U većim gustinama dobijen je veći broj klijavih semena po jedinici površine (13.122.000, 15.022.000, 15.569.000). U sve tri gustine procentualno učešće frakcija u masi bilo je ujednačeno.

Primljeno 12. XI 2004.
Odobreno 7. II 2005.